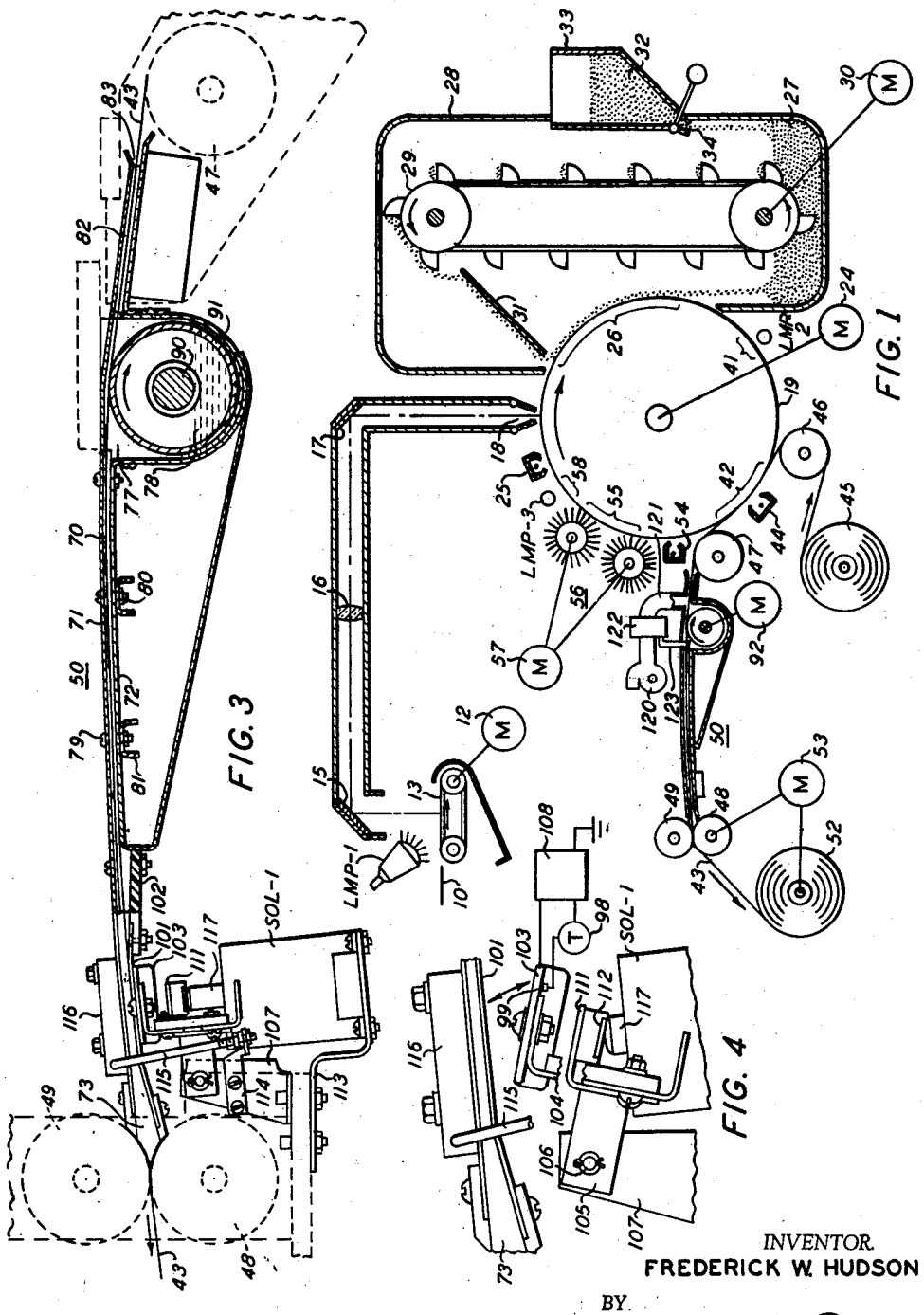
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XEROGRAPHIC FIXING APPARATUS

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XEROGRAPHIC FIXING APPARATUS

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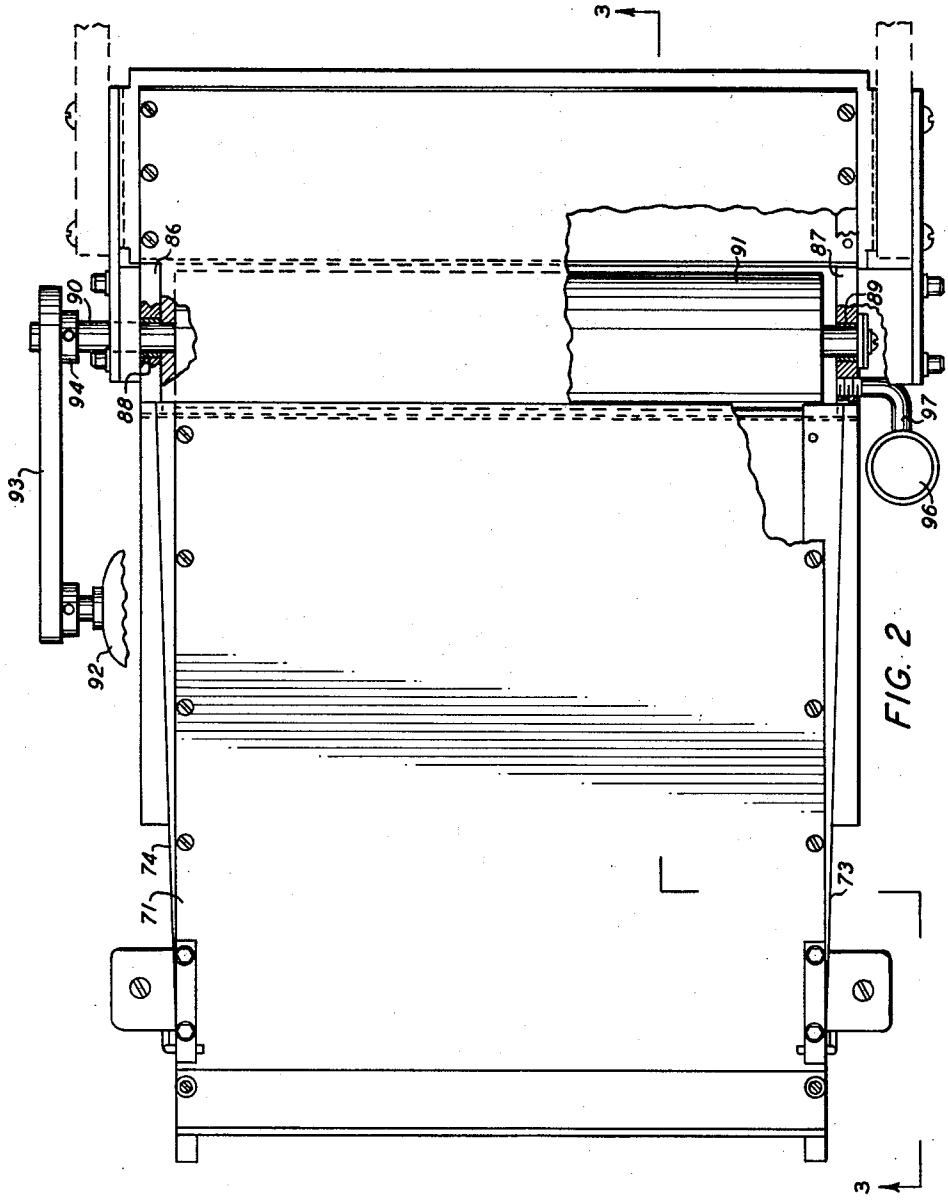


FIG. 2

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XEROGRAPHIC FIXING APPARATUS

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This invention relates to improved apparatus for fusing powder images onto the surface of support material. More particularly, the invention relates to xerography and to vapor fusing of powder images loosely formed xerographically onto a support web.

In the process of xerography, as first disclosed, for example, in Carlson patent U.S. 2,297,691, a previously formed electrostatic latent image on the surface of a xerographic plate is rendered visible by developing with a powder deposited on the plate surface. Commercial forms of powder used for developing are usually of a pigmented resin such as disclosed in Rheinfrank et al. patent U.S. 2,788,288 and Carlson patent U.S. Reissue 25,136. The powder image thus formed is then affixed to the surface upon which it has been deposited or onto the surface of another support material to which it may have been transferred by techniques known to those skilled in the art.

Conventionally there are two usual methods by which a powder image is affixed. The first of these methods is with the application of heat in which case the powder image or its support must be formed of a thermo-responsive material, such as a heat fusible resin, which flows without image distortion when heated and coalesces when cooled to ambient temperature. The second of these methods is to introduce the image-bearing support material into an atmosphere of the vapor of a solvent for the developing powder as disclosed in Carlson patent U.S. 2,776,907. In the solvent vapor process, the powder image is rendered a tacky cohesive mass while in the presence of the atmosphere of solvent vapor and while still tacky is removed to ambient air for evaporation of the solvent, leaving the image bonded to the support member. The solvent vapor process is sometimes referred to as "vapor fixing."

While heat fusing has been put to practical use, certain difficulties have been encountered and particularly in automatic machines. For example, most commercially marketed machines employ a thin layer of vitreous selenium as the photoconductor. Continuous heat exposure is known to have a deleterious effect on the photoconductive properties of selenium. Dissipation or insulation of the heat, therefore, must be carefully controlled. When the image is to be fused to paper, cellulose acetate or other base having a relatively low charring or combustion temperature, as is usually the case, the powder must be made of material which becomes adhesive at a temperature below that which will cause damage to the base. This imposes limitations on the choice of resins which make it difficult to meet other desirable characteristics in the powder composition. In addition, certain paper stocks such as used in record controlled accounting cards have controlled moisture contents which are decreased at high temperature destroying the cards for their intended purpose. Moreover, it has become difficult to reach an entirely satisfactory design of heat fuser with regard to a short warm-up time, low electric current requirements, adequate heat insulation and uniform heat distribution without the attendant disadvantage of fire hazard associated with fusers employing heat as the fusing media.

Vapor fixing of powder images by means of a solvent vapor has also been put to a practical use and found to

form dense, blacker images than formed by heat fusing. Most solvents suitable for use in conjunction with these resins generally used in toners are characterized by various orders of undesirability such as odors, toxicity, etc. Operation of a vapor fusing device of the prior art included removal or emergence of an image bearing support surface from the vapor chamber with which there has been known to be associated "vapor dragout," i.e., a volume layer of solvent vapor accompanying and accelerated by the moving support surface. This dragout not only has contributed to the inefficiency of the system but its effect on air dilution has caused general uncomfortableness for the operators of the apparatus in attendance not to mention the inherent toxic dangers. Where there is likely to be large volumes of copy to be fused, or is usual with automatic xerographic machines operated continuously, expensive and bulky ventilation equipment has been required to avoid contamination of the ambient atmosphere. Because of this, heat fusing with all its attendant handicaps has generally gained wide commercial favor over vapor fusing.

Aside from the undesirabilities mentioned above, the particular solvent employed depends on the nature of the particular image material or base on which the image is to be supported. Trichloroethylene is hereinafter named as a solvent for one particular image material of the type referred to above and it is to be realized that other solvents or tackifiers may be used. For example, suitable solvents include chloroform, carbon tetrachloride, trichloroethylene and other chlorinated solvents; the various Freons (believed to be fluorinated lower alkanes); aromatic and aliphatic hydrocarbons such as benzene, toluene, gasoline and gasoline fractions; oxygenated solvents such as ethanol, acetone, ethyl acetate and other alcohols, ketones, esters and the like. In all cases, the particular solvent will be appropriately selected to operate empiracally with the particular combination of materials and compositions employed.

Thus while trichloroethylene has been found particularly suited for fusing xerographic images, it is characterized by objectional odor and a degree of toxicity which can raise to an objectional level if allowed to escape to a room at a high rate. Apparatus therefore employing trichloroethylene as a fusing solvent, and vapor fusing in general, has been largely limited to intermittent applications and commercial apparatus causing solvent dilution to the ambient atmosphere below the toxic limit for human occupancy. One such commercial apparatus of the prior art includes a substantially vapor-tight chamber for containing the saturated vapor of trichloroethylene. The chamber is maintained closed except for intermittent opening for insertion and removal of the support material bearing the image. By this means, vapor escape to the ambient atmosphere is restricted to short periods when the chamber is open.

Now in accordance with the instant invention, there is provided improved method and apparatus by which the technique of vapor fusing can be adapted to continuous fusing operations particularly suited for automatic apparatus. This is accomplished in the manner of the invention by passing a continuous web through an elongated vapor chamber in which vaporized solvent is contained for fusing the image material to the support surface. As the web enters the chamber, the web is relatively cool and the vapor condenses thereon to effect fusing. Before exiting, the condensed solvent is caused to be volatilized such that the web emerges from the chamber substantially free of solvent. This recycling minimizes carry-out to the atmosphere while substantially reducing overall solvent consumption. In addition, in one embodiment of the invention, liquid solvent

is metered to the backside of the web to permeate into contact with the image material. This achieves a most proficient fixing of the image, since solvent contact is effected at the junction of the image and support surface while at the same time, volatilized solvent is condensing on the image side of the entering web.

It is, therefore, an object of the invention to provide novel method and apparatus for vapor fixing of powder images onto surfaces of support material on which the powder is loosely supported.

It is a further object of the invention to provide improved vapor fixing apparatus for continuous fixing of xerographic powder images to moving support material.

It is a further object of the invention to achieve vapor fixing of xerographic powder images by improved method and apparatus resulting in substantially reduced solvent consumption and release as compared to other such devices of the prior art.

It is still a further object of the invention to provide novel vapor fusing apparatus having wide flexibility of operation for affixing powder images onto a continuous moving web movable through a range of different speeds.

An embodiment in accordance with the invention is illustrated in the following drawings in which:

FIG. 1 is a schematic arrangement of an automatic xerographic apparatus incorporating the fuser apparatus of the invention;

FIG. 2 is an enlarged plan view of the fuser apparatus;

FIG. 3 is a sectional elevation taken substantially along line 3—3 of FIG. 2; and

FIG. 4 is an enlarged sectional view of the heating element of the fuser illustrated in FIG. 3.

For a general understanding of the xerographic processing system by which the invention is being illustrated, reference is had to FIG. 1 in which the various system components are schematically illustrated. As in all xerographic systems based on the concept disclosed in the above-cited Carlson patent, a light radiation image of copy to be reproduced is projected onto the sensitized surface of a xerographic plate to form an electrostatic latent image. Thereafter, the latent image is usually developed with oppositely charged developing material to form a xerographic powder image, corresponding to the latent image, on the plate surface. The powder image is then generally electrostatically transferred to a support surface to which it is usually fused by a fusing device causing the image to permanently adhere to the support surface.

The xerographic apparatus described herein typically may be of the type disclosed in copending application Serial No. 837,173, filed August 31, 1959, in the names of A. J. Cerasani et al., now Patent U.S. 3,076,392. Opaque copy to be reproduced is placed on a support tray **10** from which it is fed onto a transport mechanism generally designated **11**. Suitable drive means are provided for the transport mechanism from motor **12** to endless belts **13** whereby copy is moved past the optical axis of projection lens system **14** and illuminated by a projection lamp LMP–1. The image of the copy is reflected by mirror **15** through an adjustable objective lens **16** and then reflected by mirror **17** downwardly through a variable slit aperture assembly **18** and onto the surface of a xerographic plate in the form of drum **19**.

Xerographic drum **19** includes a cylindrical member mounted in suitable bearings in the frame of the machine and is driven in a clockwise direction by a motor **24** at a constant rate that is proportional to the transport rate of the copy, whereby the peripheral rate of the drum surface is identical to the rate of movement of the reflected light image. The drum surface comprises a layer of photoconductive material on a conductive backing that is sensitized prior to exposure by means of a corona generating device **25** energized from a suitable high potential source.

The exposure of the drum to the light image discharges the photoconductive layer in the areas struck by light, whereby there remains on the drum a latent electrostatic image in image configuration corresponding to the light image projected from the copy. As the drum surface continues its movement, the electrostatic latent image passes through a developing station **26** in which a two-component developing material **27**, which may be of the type disclosed in the above cited patents, is cascaded over the drum surface by means of developing apparatus **28** which may be of the type disclosed in copending application Serial No. 393,058, filed November 19, 1953, now abandoned, in the names of C. R. Mayo et al.

In the developing apparatus, developing material is carried by conveyor **29** driven by suitable drive means from motor **30** and is released onto chute **31** and cascades down over the drum surface. The toner component of the developer is consumed in developing. Additional toner **32** is stored in dispenser **33** and is released in amounts controlled by gate **34** to the developer to replenish and assure uniform development.

After developing, the xerographic powder image passes a discharge station **41** at which the drum surface is illuminated by a lamp LMP–2, wherby residual charges on the non-image areas of the drum surface are discharged. Thereafter, the powder image passes through an image transfer station **42** at which the powder image is electrostatically transferred to a support surface web **43** by means of a second corona generating device **44**.

The support surface to which the powder image is transferred is, for the purpose of this invention, preferably one not impervious to liquid and may be paper, vellum, card stock, etc. The support surface is obtained from a supply roll **45** and is fed over suitably grounded guide rolls **46** and **47**, and over suitable tensioning rolls being directed into surface contact with the drum in the immediate vicinity of transfer corona generating device **44**. After transfer, the support surface is separated from the drum surface and guided through the fusing apparatus of the invention **50** to be described, whereby the powder image is permanently affixed to the support surface. In most known commercial machines of the type being described, this fusing apparatus has been of the heat fusing type as, for example, disclosed in Crumrine Patent U.S. 2,852,651. Thereafter, the support surface is fed over a further system of guide and tensioning rolls, through pinch rolls **48** and **49** and then optionally onto a take-up roll **52** that is driven by motor **53** or may be passed directly out to a cutter or the like in which the web is cut into severed lengths.

After separation of the support surface from the drum, a corona generating device **54** directs negative electrostatic charge to the residual powder image on the drum surface.

After transfer and negative charging, the xerographic drum surface passes through a cleaning station **55** at which its surface is brushed by a cleaning brush assembly **56**, rotated by a motor **57**, whereby residual developing material remaining on the drum is removed. Thereafter, the drum surface passes through a second discharge station **58** at which it is illuminated by a fluorescent lamp LMP–3, whereby the drum surface in this region is completely flooded with light to remove any electrostatic charge that may remain thereon. Suitable light traps are provided in the system to prevent any light rays from reaching the drum surface, other than the projected image, during the period of drum travel immediately prior to sensitization by corona generating device **25** until after the drum surface is completely passed through the developing station **26**.

Reference is now more particularly directed to FIGS. 2, 3 and 4 in which the fuser apparatus of the invention is shown in more detail. As can be seen, the fuser apparatus is mounted to substantially span the distance from

guide roll 47 into the bite approach of pinch rolls 48 and 49.

The fuser includes an elongated chamber section 70 through which web 43 passes. The chamber is defined as the space formed between top plate 71, bottom plate 72 and side spacers 73 and 74 which terminate in a wedge contoured concavely at the fuser exit just preceding the pinch rolls. The bottom wall 72 also forms a structural part of the solvent reservoir 77 in which is contained a controlled level of liquid solvent 78 which may be trichloroethylene or the like. It will be noticed that both the top and bottom walls, or at least the bottom wall, is slightly arched vertically upward so that the non-image carrying surface of the web in advancing tautly thereover will advance in continuous contact with the bottom wall surface. The chamber height is defined by the height dimensions of side spacers through which the entire chamber components are secured relative to each other in assembled relation via bolts 79 and nuts 80 while channel members 81 accord rigidity to the bottom plate. On the other or entering side of the reservoir is an entrance chamber 82 similarly constructed and substantially a continuation of chamber 70. A diverging separation by the top and bottom walls at the entrance forms a mouth 83 through which the web continuously enters the fuser.

The reservoir 77 constitutes a liquid-tight container having side walls 86 and 87 containing bearings 88 and 89, respectively, in which a shaft 90 is transversely mounted for rotation. Secured to the shaft is a cylinder member 91 constituting a liquid roll dispenser which is partially immersed in the liquid solvent to a degree as will be discussed. The roller in the illustrated embodiment has a relatively smooth periphery to which a thin surface film of liquid solvent will adhere as a result of surface tensoin.

Rotation of the cylinder is effected via motor 92 which through a timing belt 93 engaging pulley 94 secured to the motor shaft, drives pulley 95 secured on shaft 90. The solvent level in the reservoir is maintained below the top periphery of the cylinder and preferably below the shaft to eliminate the necessity for seals. As the cylinder rotates, the solvent film on its upper periphery is tangentially wiped against the underside of the web moving therepast. This wiping causes wetting of the web surface to a degree dependent on various factors such as relative web porosity, solvent employed, thickness of solvent film, length of wiping contact, etc. Having deemed a solvent to be suitable, wide flexibility of fusing quality, that is, the degree of bond to be effected by fusing can largely be controlled by varying the quantity of solvent presented to a given length of web. One procedure found suitable for varying the metered presentation of solvent has been to vary the relative speeds between the roller and web. Either or both may be varied but preferably the roller speed is changed by employing a variable speed motor 92 in conjunction with the appropirate controls such as a potentiometer. Control can further be refined by appropriate selection of the rotative direction of the roller relative to the web such that presentation of solvent is either the same or opposed to the direction of web movement. It has been found that greater uniformity results where the roller is rotated in the direction opposite to that of the web as illustrated in the accompanying drawings. This results in the wetted periphery portion of the roller dispenser contacting the "wetter" surface of the web while the "dryer" portion of the periphery contacts the dryer portion of the web.

The solvent level in the reservoir is maintained substantially constant in order that the ratio of immersed periphery to un-immersed periphery be substantially constant. Level of solvent is maintained by means of an elevated dispenser 96 feeding through a tube 97 that opens into the reservoir.

As the web advances over the roller dispenser 91, the back side is coated with a film of liquid solvent contained in reservoir 77, the quantity of which has been determined adequate for the combination of web speed, material composition and solvent being employed. The web continues to advance and by virtue of the vertical arching or humping of bottom wall 72, the web slides substantially in contact along its surface. In advance of the web reaching the pinch rolls 48 and 49, the web passes over a heater 101 aligned with substantial surface continuity with the bottom wall but separated therefrom by means of adjacently supported thermo-insulating plate 102.

Thermo-energy for heater 101 is conductively supplied from an electrically energized heater platen 103 secured to a channel support bracket 104 having spaced flanges 105 adapted to pivot about pin 106 extending therethrough and supported on support post 107. Secured to bracket 104 is a channel bracket 111 supporting a transversely extended leaf spring 112. Mounted below the heater directly below the leaf spring is a solenoid SOL–1 secured via a bracket 113 to the underside of support post 107. The solenoid is further supported via bracket 114 and operatively aligned via screw pins 115 pivotally suspended in support bar 116.

The heater is itself adapted to be conductively heated selectively to a surface temperature adequate to volatilize the small quantity of liquid solvent on the back of the web. This temperature will vary dependent on the particular liquid solvent, web material and speed of operation. It is not necessary that the web attain a coincident temperature as the heater and preferably, it is to be avoided to obtain the benefits of this invention. As the web moves across the heater, the short duration of contact effects slight heating of the web but it raises the solvent temperature above its boiling point which for trichloroethylene is approximately 189° F. Control for heater temperature is achieved by selective operation of SOL–1 having its armature rested upon by leaf spring 112 such that when the solenoid is energized, the armature extends upward against the leaf spring urging the heater and platen 103 to be pivoted upwardly against heater bar 101. In the embodiment illustrated, the heater platen 103 is intermittently energized by means of a temperature controller including a thermo-actuated switch 98 having its sensing element 99 attached against the under surface of heater 103 and adapted to control the power supply from power source 108. Thus when the fuser is in operation, the platen 103 urged against heater 101 by continuously energized solenoid SOL–1 such that the surface temperature of 101 is raised to a predetermined maintained level. When operation is discontinued, the solenoid is de-energized permitting the platen to pivotally fall away and enable heater cooling.

Solvent on the web permeates the web upwardly and heating volatilizes the solvent leaving the powder image fused thereon. This permits the web to emerge from the chamber bearing a fused image before entering the bite of the pinch rolls which are in a position to block escape of the vapor from the chamber exit. The vapor volatilized on heating, having no relief exit, will generate a slight thermo-pressure within the chamber causing the vapor to expand and drift backward in the chamber toward the entrance mouth 83. This serves a dual purpose, by first, reducing the consumption of solvent in that the volatilized solvent is reused by recondensing on the relatively colder image side of the web in the vicinity of the reservoir and second, by applying solvent to both the bottom and top side of the powder image formation to obtain a more homogeneous vapor contact to the image material. Therefore, after initial startup of the system, a balance is soon reached in which maximum utilization of the applied solvent is maintained resulting in very little dragout to the ambient atmosphere.

It is believed that only solvent liquid is effective in fixing the powder image. When unfixed toner images are exposed to solvent vapor, condensation must take place and increase the concentration of liquid at the toner surface to soften the toner and cause it to co-

alesce. By heating the web, the solvent is boiled out of the paper and the vapors move as aforesaid towards cooler areas of the web. Because the incoming paper is cold in respect to the volatilized solvent, some of the solvent condenses on the surface of the paper thus adding to the solvent metered to the back of the paper by the solvent dispensing roll **91**. This sets up a recycling of solvent within the fuser, with the dispensing roll speed set to add only the solvent which is lost within the fixed copy. As should be apparent, the fusing chamber should be substantially sealed against vapor leakage for efficient operation of the system.

A solvent employed must of necessity be a solvent for the material constituting the powder image and for obvious reasons should be non-explosive. The following list taken from various handbooks such as the Handbook of Organic Industrial Solvents, published by the National Association of Mutual Casualty Companies, indicates a summary of allowable maximum concentrations in the atmosphere of sample solvents to maintain the atmosphere below unsafe levels of toxicity. The concentrations are expressed in parts per million (p.p.m.) and as listed include trichloroethylene at 200 p.p.m.; chlorethene at 500 p.p.m.; Freon 112 at 1000 p.p.m.; Freon 11 at 1000 p.p.m.; and Inhibisol at 500 p.p.m. These solvents have each been found to accord various degrees of using when used in conjunction with developer of a type described in the above-cited patents. It is not intended, however, that the named solvents should in any way constitute a limitation relevant to the instant invention.

Of the solvents named for fusing images of developer customarily used commercially in xerography, trichloroethylene has been found the most effective. However, as can be seen from the above, trichloroethylene is also the most toxic of the solvents mentioned. Therefore, with the high order of toxicity that results in the absence of substantial ventilation or special venting attachments, the application of trichloroethylene on a continuous basis has generally been avoided since the allowable limits of toxicity can soon be reached. Typically to fuse approximately 1650 square feet of copy per hour in a room with a normal air diffusion of about 50 c.f.m. by prior art methods would require approximately 790 c.f.m. of additional previously uncontaminated ventilated air to maintain the room below the toxicity level. By contrast, the method and apparatus of the invention has an actual consumption so low that the same 1650 square feet of copy can be fused to the same requirement standards of toxicity without additional room ventilation. This reduction in solvent consumption results not only in a saving of material solvent cost but results also in a substantial savings in ventilation costs which is a function to a large degree of the extent to which the air is to be heated or otherwise treated prior to its introduction to the ventilated space.

In operation, a web bearing a xerographic image passes continuously through the fuser. On entering the fuser, the image is loosely supported and on passing over roller **91**, the back side of the web is wetted with solvent. Wetting is effected to a degree sufficient to permeate the paper contacting the underside of the image at the junction with the web surface. On passing over the heater **101**, the solvent is boiled off and vaporized and the vapor drifts or is urged backward towards the incoming portion of the web. On striking the cooler web in the vicinity of reservoir **77**, the vapor recondenses thereon. Operation is continuous and by this means, continuous paper web, providing a fusing area of approximately 27.5 square feet per minute, is found to emerge containing images with a commercially standard fused bond when employing trichloroethylene as the solvent and without the aid of any room ventilation. That is, a tolerable level of atmospheric toxicity was maintained without resorting to an external exhaust system. In the event of machine shutdown, the machine is programmed to first discontinue operation of motor **92** while de-energizing solenoid SOL–**1**. On start up, web transport is delayed until the fuser heater attains operating temperature.

The apparatus of the invention, therefore, constitutes a substantial improvement over other such devices for achieving the same purpose in the prior art in that continuous operation is achieved with tolerable dragout without external ventilation and at the same time, reducing the solvent consumption by approximately 94 percent. It is not intended, however, to give the impression that the exhaust has been found totally unnecessary within operating ranges previously requiring large volume of air exhaust. Obviously, under highly rapid or extreme operating condition in ranges generally above 27.5 square feet per minute, some degree of exhaust may be required. Under these conditions in which exhaust is required, a further variation in the form of optional accessories is contemplated and shown only in FIG. 1 by routing the exhaust induced by a blower **120** from the vicinity of the entering web through conduit **121** over a refrigerated condensing coil **122**. Since the trichloroethylene is vaporized from the paper by heating, it will readily condense on a refrigerated coil to drip to the lower portion of the coil whereat it can be collected and returned via tube **123** to reservoir **77**. By this means, substantially complete recovery of the solvent in the exhaust can be effected enabling continuous recycling of the reclaimed solvent, while the balance of exhaust air is directed harmlessly elsewhere.

Under conditions in which the solvent is not completely evaporated before the web feeds into the bite of the pinch rolls, slight image offsetting has been found to occur onto roll **49**. The effect of this has been satisfactorily overcome by employing a relatively adhesive surface such as "Teflon" and wiping the surface with a silicone oil by means of felt wipers, or the like, mounted in contact against the roll. With this arrangement, offsetting was virtually eliminated.

As an alternative to the embodiment described above, a further variation has been found to achieve fusing where the web is of material relatively impervious to solvent liquid such as some forms of vellum, cellulose acetate, and plastic impregnated papers. Under these conditions, it is possible to effect fusing without wetting the back side of the web. With the components otherwise similarly arranged as above, a vapor atmosphere is generated by heating a quantity of solvent liquid or by a wick or the like partially immersed in the solvent so that the web passes through a continuous atmosphere of vapor of the solvent. The web is heated as before in the same general arrangement as described above, such that vapor is volatilized off in the vicinity of the heater and then recondenses on the relatively cooler web in the entering portion of the chamber. This, then, would operate similarly but without the added benefit of solvent permeation caused by liquid solvent on the underside of the web.

Since many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the drawings and specification shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Apparatus for affixing a powder image to the surface of a moving web sheet comprising in combination:

(*a*) walls forming an enclosed substantially vapor tight elongated fusing chamber having a defined internal generally unobstructed and enclosed passage extending at least partially the length thereof to permit a substantially unimpeded vapor flow along the surface of a web sheet on which a powder image having a solvent soluble component is supported;

(*b*) an entrance and an exit opening defined by at

least one chamber wall and connecting to said passage through which a web sheet containing a powder image can enter and exit said chamber;

(c) a solvent reservoir adjacent the passage of said chamber for containing a quantity of liquid solvent for the soluble component of the powder material comprising the powder image;

(d) dispensing means extending from the reservoir into said defined passage to uniformly wipe a metered quantity of liquid solvent from said reservoir against an advancing portion of the non-image supporting surface of the moving web sheet;

(e) heating means within said passage beyond said dispensing means in the direction of web movement and adapted to apply heat against the non-image supporting surface of the web on which liquid solvent has been applied to vaporize solvent from the web; and

(f) seal means at the exit of said chamber to substantially prevent the vaporized solvent from escaping therepast and to effectively cause vaporized solvent to drift in said passage away from the vicinity of said exit in a direction toward said entrance along portions of powder image on the web sheet.

2. Apparatus for affixing a powder image to the surface of a moving web sheet comprising in combination;

(a) an elongated fusing chamber including spaced top wall, bottom wall and side walls secured substantially vapor tight to each other and defining an internal generally unobstructed and enclosed passage extending at least partially the length thereof to permit a substantially unimpeded vapor flow along the surface of a web sheet therein;

(b) an entrance and exit opening defined by at least one chamber wall and connecting to said passage for the passing therethrough of a web sheet on which a powder image having a solvent soluble component is supported;

(c) a solvent reservoir adjacent the passage of said chamber for containing a quantity of liquid solvent for the soluble component of the powder material comprising the powder image;

(d) dispensing means extending from the reservoir into said defined passage to uniformly wipe a controlled quantity of liquid solvent from said reservoir against an advancing portion of the non-image supporting surface of the moving web;

(e) heating means within said passage beyond said dispensing means in the direction of web movement and adapted to apply heat conductively against the non-image supporting surface of the web on which liquid solvent has been applied to vaporize solvent from the web; and,

(f) seal means at the exit of said chamber to substantially prevent the solvent vaporized by said heating means from escaping therepast and to effectively cause vaporized solvent to drift in said passage away from the vicinity of said exit in a direction toward said entrance along portions of powder image on the web sheet.

3. Apparatus for affixing a powder image to the surface of a moving web sheet comprising in combination:

(a) an elongated fusing chamber formed of spaced apart walls secured substantially vapor tight to each other and defining an internal generally unobstructed and enclosed passage extending at least partially the length thereof to permit a substantially unimpeded vapor flow along the surface of a web sheet therein;

(b) an entrance and exit opening defined in the front and rear of said chamber and connecting to said passage for the passing therethrough of a solvent permeable web sheet on which a powder image having a solvent soluble component is supported;

(c) a solvent reservoir adjacent the passage of said chamber for containing a quantity of liquid solvent for the soluble component of the powder material comprising the powder image;

(d) a rotatable roll solvent dispenser supported at least partially immersed in solvent in said reservoir and adapted to uniformly wipe a controlled quantity of liquid solvent from the periphery of said roll against an advancing portion of the non-image supporting surface of a moving web sheet in said passage;

(e) a thermally controlled heating platen within said passage beyond said roll dispenser in the direction of web movement and adapted to apply heat to the non-image supporting surface of the web on which liquid solvent has been wiped to vaporize solvent from the web; and,

(f) seal means at the exit of said chamber to substantially prevent the solvent vaporized by said heating means from escaping therepast and to effectively cause vaporized solvent to drift in said passage away from the vicinity of said exit in a direction toward said entrance along portions of powder image on the web sheet.

4. The apparatus acording to claim 3 in which said roll can be rotated in a selective direction relative to the movement of the web.

5. The apparatus according to claim 3 including controllable roll drive means whereby the rate of roll rotation can be arbitrarily pre-set and varied correlated to requirements.

6. Apparatus for affixing a powder image to the surface of a moving web sheet comprising in combination:

(a) an elongated fusing chamber including spaced top wall, bottom wall and side walls secured substantially vapor tight to each other and defining an internal generally unobstructed and enclosed passage extending at least partially the length thereof to permit a substantially unimpeded vapor flow along the surface of a web sheet therein;

(b) an entrance and exit opening defined by at least one chamber wall and connecting to said passage for the passing therethrough of a solvent permeable web sheet on which a powder image having a solvent soluble component is supported;

(c) seals adjacent the exit of said chamber to substantially block the escape of free solvent vapor from said chamber through said exit and to effectively cause vaporized solvent to drift in said passage away from the vicinity of said exit in a direction toward said entrance along portions of powder image on the web sheet;

(d) a solvent reservoir adjacent the passage of said chamber for containing a quantity of liquid solvent for the soluble component of the powder material comprising the powder image;

(e) a rotating cylinder solvent dispenser means supported partially immersed in solvent in said reservoir and having a surface capable of retaining a quantity of liquid solvent thereon for wiping against an advancing position of the non-image supporting surface of a moving web sheet in said passage; and,

(f) a thermally controlled heating platen within said passage beyond said cylinder dispensing means in the direction of web movement and adapted to apply heat against the non-image supporting surface of the web on which liquid solvent has been wiped to vaporize solvent from the web whereby the image is affixed and the web is largely free of solvent as it emerges from said chamber through said exit.

7. In a xerographic apparatus including means to reproduce copy in the form of powder images having a solvent soluble component loosely adhering on a web sheet, means to advance the sheet, and fusing means adapted to affix the powder image to the surface of the

sheet during the course of its movement, an improved fusing means comprising in combination:

(*a*) an elongated fusing chamber including spaced top wall, bottom wall and side walls secured substantially vapor tight to each other and defining an internal generally unobstructed and enclosed passage extending at least partially the length thereof to permit a substantially unimpeded vapor flow along a surface of a web sheet therein;

(*b*) an entrance and exit defined by at least one chamber wall and connecting to said passage for the passing of a web sheet therethrough;

(*c*) a solvent reservoir adjacent the passage of said chamber for containing a quantity of liquid solvent for the soluble component of the powder material comprising the powder image;

(*d*) dispensing means extending from the reservoir into said defined passage to uniformly wipe a metered quantity of liquid solvent from said reservoir against an advancing portion of the non-image supporting surface of the moving web sheet;

(*e*) heating means within said passage beyond said dispensing means in the direction of web movement and adapted to apply heat to the non-image supporting surface of the web after application of liquid solvent thereto to vaporize solvent from the web; and,

(*f*) seal means at the exit of said chamber to substantially prevent the solvent vaporized by said heating means from escaping therepast and to effectively cause vaporized solvent to drift in said pasage away from the vicinity of said exit in a direction toward said entrance along portions of powder image on the web sheet.

8. The apparatus according to claim 7 in which said reservoir is arranged in said chamber below the path of web movement.

9. The apparatus according to claim 7 including a makeup source of liquid solvent, and second dispensing means adapted to feed liquid solvent from said source to said reservoir to substantially maintain the level of solvent contained in said reservoir.

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